

قسم الهندسة المدنية

المرحلة الثالثة

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Lecture - 1

Design of channels

Introduction

For carrying water from the canal head works to the field, a well-designed distribution system consisting of a network of canals is required. The canals taking off from a canal head works carry the water to far off place for various purposes, such as irrigation, hydropower and navigation.

The capacity of irrigation canals depends upon the water requirements of the corps and the area irrigated.

Canal can be defended as an artificial channel constructed on the ground to carry water from a river or another canal or a reservoir to the fields. Usually, canals have a trapezoidal cross-section.

Types of canals

The canals can be classified in to different types based on different criteria:

- a) Classification based on size.
- b) Classification based on canal surface.
- c) Classification based on purpose
- d) Classification based on alignment.

a) Classification based on size: based on the size, the canal can be divided in to the following types: -

- 1. Main canal.
- 2. Branch canal.
- 3. Major distributaries.
- 4. Minor distributaries.
- 5. Water course.

1- Main canal: main canal is the largest canal in the system. It takes off directly from canal headwork, which maybe a diversion headwork's, or storage headwork.

هناك أما R.M.C أو L.M.C

Sometimes there are two or more main canals on either side.

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2- Branch canal: A branch canal takes off from a main canal or another branch canal. (carry discharge higher than $5m^3/sec$).

3- Major distributaries (0.25 to $5m^3/sec$).

4- Minor distributaries or minor (less $0.25 m^3/sec$).

5- Water course (or filed channels or gulls): Watercourse are small channels which take water from a branch canal, a major distributaries or a minor distributaries and supply it to the agricultural fields.

B) Classification based on canal surface:

1. Lined canals.
2. Unlined canals.

1- Lined canals: A lined canal is the one which has its surface lined with an impervious material on its bed and sides to prevent seepage of water. Therefore, the seepage losses in a lined canal are small.

2- Unlined canals: An unlined canal is the one, which has the surface of the natural material through which it is constructed and it is not provided with a lining on its surface. The seepage losses are large.

c) Classification based on purpose: based on the purpose served:

1. Irrigation canal.
2. Power canal.
3. Navigation canal.
4. Water supply canal.
5. Feeder canal.
6. Carrier canal.
7. Multipurpose canal.

D) Classification based on alignment:

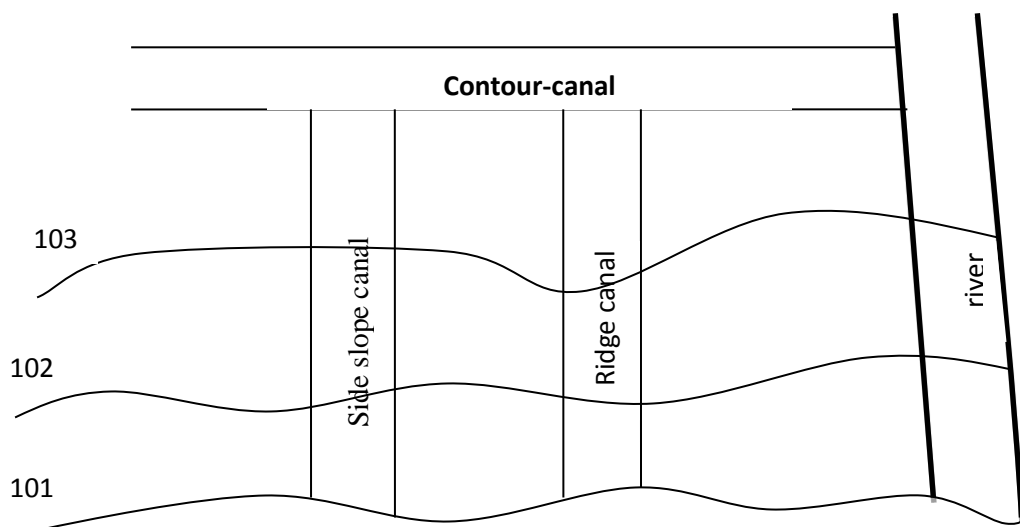
1. Watershed (or ridge canals).
2. Contour canals.
3. Side slope canals.

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1- Water shed: the canal which is aligned along a watershed (or ridge) is called a watershed canal, it can irrigate on both sides of the ridge by gravity.

2- Contour canals: A contour canal is aligned almost parallel to the contours of area.

3- side-slope canals: a side-slope canal is aligned at right angles to the contour lines along the side slopes of the terrain.



Design of channels

The design of the canal is mainly governed by the quantity of silt in the water and the type of boundary surface of the canal.

Shape of cross-section of the canal.

A. rectangle

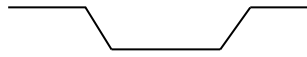


B. triangle



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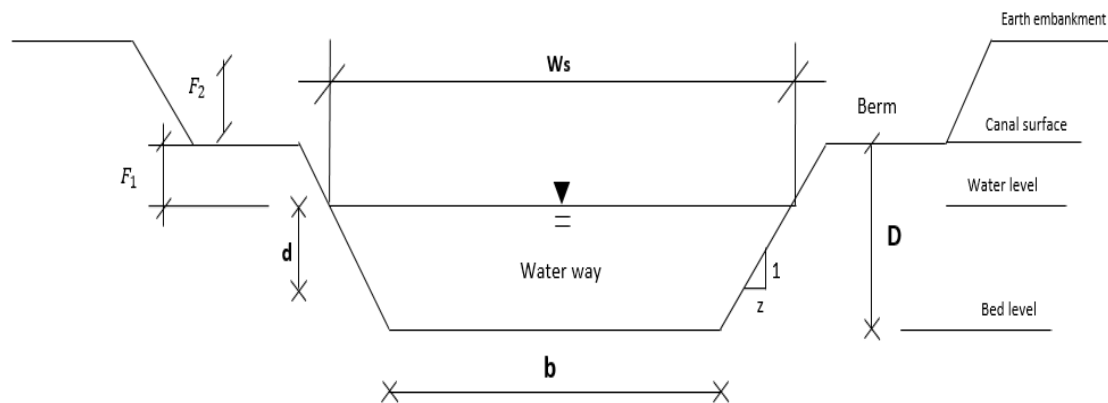
C. trapezoid



D. semi-circle



E. parabola



Canal cross-section

b = bed width (m)

W_s = water surface width (m)

Y, d = water depth (m)

D = total depth of the canal (m)

$1:z$ = side slope of the canal

F_1, F_2 = free board (m)

S = longitudinal slope

Water way: the part of the canal cross-section in which the water flow.

Berm: the area between the canal cross-section and the side embankment used as a road or for maintains.

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F_1 : the distance between the water surface and the canal surface used for the protection from overtopping (flooding).

F_2 : the distance between the canal surface and the embankment level, used for protecting from flooding.

Basic design assumption (simplified assumption).

- a. The flow is due to gravity.
- b. The flow is uniform and steady state.